JBL PROFESSIONAL ENCLOSURE GUIDE

1 For single **2202, 2220, E120** or **G125** used as midrange or for guitar.
2 For single **2204, 2206** used as general purpose low-end or MI bass
3 For single **128H** hi-fi low-end or small subwoofer.
4 For single **2220, E130**, or **G135** used full-range or for MI bass.
5 For single **LE8T-H** used full range (flat, down to 30 Hz).
6 For single **2205, 2225, 2226, 2227, E140, E145**, or **G135** for general purpose low-end.
7 For double **2204, 2206** used as general purpose low-end or MI bass.
8 For single **2234, 2235, 2215/LE15** used as hi-fi low-end or subwoofer.
9 For single **E155** in smallest box for bass guitar.
10 For double **2225, (2205), 2226, E145, E140 or G135** for general purpose low-end.
11 For single **2245** subwoofer.
12 For double **2245** subwoofer.
13 For single **2241 or 2242** subwoofer.

Note: *All Dimensions are in inches and cubic feet*

Chart #	Enclosure Volume (cubic feet)	Tuned Frequency (Hz)	Enclosure Inside Dimensions			Vent Area (square inches)	Equivalent duct tube and ID	Length (in.)
			Height (in.)	Width (in.)	Depth (in.)			
1	1.5	80	17.4	14.2	12.3	13.9	(1) 4.2	(3/4")
2	2.0	40	18.9	15.4	13.4	12.6	(1) 4.0	7.6
3	2.5	30	20.2	16.5	14.3	12.6	(1) 4.0	11.9
4	3.0	40	21.4	17.5	15.1	12.6	(1} 4.0	4.0
5	3.4	32	22.1	18.0	15.6	12.6	(1) 4.0	6.8
6	4.0	40	23.6	19,2	16.7	25.1	(2) 4.0	6.5
7	4.0	40	25.0	18.0	17.4	25.1	(2) 4.0	6.5
8	5.0	30	25.3	20.7	17.9	25.1	(2) 4.0	11.0
9	6.0	40	27.0	22.0	19.1	50.3	(4) 4.0	8'.2
l0	8.0	40	32.0	24.0	19.4	50.3	(4) 4.0	5.0
11	10.0	30	32.0	26.1	22.6	75.4	(6) 4.0	15.2
12	20.0	30	40.2	32.8	28.4	150.8	(3) 8.0	12.5
13	10.0	40	32.0	26.1	22.6	75.4	(6) 4.0	5.5

***Box Dimensions are in inches**

Note: Models 2118, 2123 and El10 used for midrange, require only a small, sealed sub-chamber of approximately 0.4 cubic foot net internal volume.

CABINET BUILDING SUGGESTIONS

Material
Dense material such as void-free "marine-grade" plywood, Finnish or Baltic birch type, 19 mm (3/4 inch) or even thicker plywood is recommended where enclosures will be transported frequently, while high-density fiber or particle board (not chip board) can be used for permanently installed use.

Comers and Edges
Comers must be strong and air tight and should not have any air leaks or openings. Glued joints should be properly filled with glue that will not crack under high stress or impact. If the integrity of the glue seal can't be determined, hot glue or caulking should be used to seal all seams. If butt-joint cabinet edges are used, care should be taken to apply cleats inside the comer edges to pull the edges tight with wood screws, assuring airtight comers and edge joints.

Bracing
The goal of cabinet bracing is to make the cabinet as rigid and *resonance-free* as possible. Bracing made of 2x4's or 75mm (3-inch) pieces of the (birch) ply should be applied inside the cabinet. The braces should be placed at slightly odd intervals on the panels and liberally glued and screwed down on edge. The glue on the braces accomplishes all the stiffening needed so be careful to apply enough glue. Use one piece of bracing on panels between 300 mm and 600 mm (12" to 24"), two pieces on panels between 500 mm and 1200 mm (18" to 36"), and three pieces on larger panels. The baffle cutout disc that is normally discarded can be glued and screwed down to one of the box panels for additional stiffening.

Duct Tubes
Ducts enlarge vent area, avoiding whistling and power compression. Ducts can be made of any rigid material such as the cardboard tubing discarded by carpet stores. Ducts can be round, square or rectangular, it makes no difference in the performance of the duct, but the cardboard tube is best because it's cheap and easy and 102 mm (4 inch) I.D. is nearly always available. If you can't find 203 mm (8 inch) tube, use four pieces of 102 mm (4 inch) tube to substitute for each larger tube. Duct length does not change when vent opening area remains constant, unless .too many smaller tubes are substituted i.e. six or eight to replace one or two. In the latter case, you may need to trim some length off to obtain the original tubing frequency.

Vent Placement
The vents in a vented enclosure operate only over a narrow band near the tuned (helmholtz) frequency and do not affect the system operation at other frequencies, therefore, it is generally not critical where vents are placed on an enclosure if you remember that the vent and woofer form a "system" which should not be disturbed or limited by nearby obstacles. It is perfectly acceptable to put a vent on the back, side, or top of an enclosure to make it fit or to make it convenient as long as the enclosure will not then be located too close to a wall or other obstacle that will obstruct the air path between woofer and vent, or so that the air flow at the vent opening is impeded. The same rule applies to the inside end of the vent as to the outside of the box: the end of the vent should be kept away from obstacles if possible, as a rule by about twice the vent dimension. The fiberglass insulating material inside the box should be fastened so as not to be drawn toward the vent by the air motion. If necessary, insulation should be removed from the immediate vicinity of the vent tube end.

Insulation
Use fiberglass to line 5 or 6 sides of the box interior. Any fiberglass will do, but if you use R-19 or R-25 insulation type fiberglass, you can ignore the volume of the bracing in the box because thick fiberglass adds virtual volume. If you must use dacron or felt instead of fiberglass, subtract its volume from the box (make the box bigger).

Do Not Expect 20 Hz From a 40 Hz Box
Bass-reflex systems should not be operated below their tuned frequency. If you try to operate the cabinet below the tuned frequency, you will break woofers. Do not try to reproduce alpha waves or lunar cycles with a speaker not designed for that purpose. The use of a high-pass filter such as the filter in the JBL 5235 Electronic Frequency

Dividing Network is highly recommended with vented loudspeaker systems to prevent sub-sonic signal from causing hazardously long cone excursion and using amplifier power at sub-sonic frequencies that make no sound from the tuned system.

Midrange
If your enclosure will include a midrange such as a 2118, 2123, or E110, build a solid sub-chamber consisting of either a tube or a box of approximately 7 liters (.25 cubic foot) to enclose and seal the midrange from the rest of the enclosure. If you use a tube, loosely fill the interior of the tube with a '~]elly roll" of fiberglass, and seal off the back of the tube with the baffle cutout for the mid driver. If you use a box, make the box dimensions *non-uniform* and line the interior with a layer of fiberglass. Don't forget to add the volume of the outside of the sub-chamber to the volume of its host' box.

Using More Than One Woofer In One Cabinet
If you want to use more than one woofer in a common box and it is not listed on the other side of this sheet, take two of the boxes that are listed and build a box inside which a divider through the center serves as a common side wall to each box, then line, brace, and port each chamber as if it were a single box.

If you have questions left unanswered by this guide, you *should get a book on cabinet-making. Books such as these are available at stores such as Radio Shack, or any good technical bookstore carrying books on electronics.*

BIBLIOGRAPHY OF RECOMMENDED AUDIO REFERENCES

FOR AUDIO NOVICES; BOOKS:

David B. Weems, "Building Speaker Enclosures," Radio Shack publication, stock# 62-2309

"The CAMEO Dictionary of Creative Audio Terms," Creative Audio & Music Electronics Organization, 10 Delmar Avenue, Framingham, MA 01701

F. Alton Everest, "The Complete Handbook of Public Address Sound Systems," Tab Books #966, Tab Books, Blue Ridge Summit, PA 17214

David B. Weems, "Designing, Building & Testing Your Own Speaker System," Tab Books #1364 (this is the same as the Weems book above)

Abratxam B. Cohen, "Hi-Fi loudspeakers and Enclosures," Hayden Book Co., 072 1

Alex Badmaieff and Don Davis, "How to Build Speaker Enclosures," Howard W. Sams & Co., Inc. 4300 West 62nd Street, Indianapolis, IN 46268

Bob Hell, "Practical Guide for Concert Sound," Sound Publishing Co., 156 East 37th Street, New York, NY 10016

FOR EXPERIENCED AUDIO PRACTITIONERS AND HOBBYISTS: BOOKS:

Jens Trampe Broch, "Acoustic Noise Measurement," Bruel & Kjaer Instruments, Inc., 185 Forest Street, Marlbourough, MA 01752 (508) 481-7000

Howard M. Tremaine, 'The Audio Cyclopedia," 2nd Edition 1969, Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, IN, 46268

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N.W. McLachlan, "Loudspeaker: Theory Performance, Testing and Design," Oxford Engineering Science Series, Oxford at The Clarendon Press 1934, Corrected Edition, Dover Publications 1960